EXECUTIVE SUMMARY

Only a handful of countries can have as dramatic an impact on global energy policy as Germany. Its large size and strategic position within Europe give it great importance in the economic region and, by extension, the world. It is, therefore, vital that the country have sound energy policies and strong energy market design. The IEA is pleased to see that Germany is making progress in these areas, which we feel will lead to benefits not just for Germany, but for Europe as a whole.

Since our last review in 2002, Germany has maintained its commitment to the "3 Es" of good energy policy: energy security, economic efficiency and environmental sustainability. In the area of security of supply, Germany has continuously maintained its strategic oil stocks above the 90-day requirement, ready to respond to any oil emergency to the benefit of all oil-consuming countries. The country has maintained the focus of its gas policy on security of supply, seeking greater partnership with Gazprom, its largest supplier.

To enhance economic efficiency, the government has undertaken actions to help improve competition in its natural gas and electricity markets. Most notably, after installing a network regulator, the *Bundesnetzagentur*, in 2005, it is now increasing the regulator's power so that it can ensure open access for new entrants and create robust and competitive energy markets. In addition, the government is working to give its cartel office the tools necessary to effectively watch over the market, making sure market participants behave fairly. A government agreement has also been reached to complete the phase-out of hard coal subsidies by 2018 – a challenging, but necessary task as sustaining uneconomic hard coal production distorts the coal market and diverts economic resources better used elsewhere to the benefit of the German economy.

In the environment arena, few countries can boast Germany's record in bringing environmental issues to the forefront of policy making. The country is on track to meet its commitment under the Kyoto Protocol, growth of renewables has been rapid, biofuels are reducing the country's reliance on imported oil, the government has set ambitious energy efficiency targets and R&D funding for renewables and efficiency is on the rise. Linking economic efficiency and environmental sustainability, the country is giving the private sector the ability to meet its greenhouse gas commitments at a lower cost by starting to expand the use of international purchases, at the same time helping to drive the international market for carbon reductions.

In light of its evident commitment to good energy policy, this review highlights areas where the government should press forward with further improvements.

The three key policy challenges are the phase-out of nuclear power, energy market reform and climate change policy.

NUCLEAR PHASE-OUT

Under an agreement negotiated between the government and the utilities in 2000, nuclear power stations will be progressively shut down as they age – with complete shut-down of all plants estimated to occur by 2022. Currently, nuclear energy makes up a significant part of the country's energy mix, representing 12% of primary supply and over a quarter of electricity generation. Modelling results suggest that the nuclear shut-down can be completed without increased emissions of carbon dioxide, thanks to a greater role for renewables along with energy efficiency gains. However, in reality it is likely that the shut-down will result in increases of lignite-, hard coal- and gas-fired power plants, particularly as companies' current slate of proposed and planned power plants lean heavily on these fuels, leading to higher overall carbon dioxide emissions.

Regardless of how nuclear power is replaced, the early shut-down of these plants comes at a cost to energy security, economic efficiency and environmental sustainability, the tenets of Germany's energy policy. The loss of nuclear power will lead to reduced supply diversity, negatively impacting energy security. As a largely domestic resource, nuclear power reduces the need to rely on imports of other fuels, such as gas; increased dependence on fossil imports in the future would likely raise Germany's reliance on Russia's Gazprom, a company that already provides a very large share of total supply. Furthermore, the supply replaced by wind power, an intermittent source, will necessitate backup reserve capacity – most likely coal and natural gas. Overall, the elimination of nuclear is a liability for energy security, as it eliminates one potential generation option from a portfolio available to German companies.

The marginal costs of nuclear plants are low and stable relative to fossil fuels, which means they provide low-cost baseload power. Nuclear plants rarely set the marginal price of electricity, so their closure will have a limited effect on wholesale electricity prices. It will, however, have negative spillover effects on the economy. The shut-down of these productive assets will require additional near-term investments in new capacity, while continued operation would allow companies to invest the revenues from the plants in ways that are more productive for the economy. Deferring the shut-down would also reduce the need for new capacity, allowing for the development of more advanced technologies, including renewable energy technologies.

In the context of Germany's ambitious targets to reduce the negative environmental impacts of energy production, the shut-down of nuclear power plants might have the biggest effect on its environmental goals. While the phase-out threatens to result in higher overall emissions of carbon dioxide than today, it will certainly prevent Germany from reaching its full potential over the longer term. With nuclear in the fuel mix, Germany's carbon dioxide emissions could be cut even further.

For these reasons, we strongly encourage the government to reconsider the decision to phase out nuclear power. Changes to the phase-out law and lifetime extensions for these productive power plants could also be linked to a reduction in free emission allocations for new and existing fossil fuel power plants, resulting in greater overall carbon dioxide reductions at no net cost, as well as to other concessions.

The government should initiate a national debate about the role of nuclear power in Germany's long-term fuel mix, with early attention paid to the possibility of extending the lifetime of existing plants in order to accommodate the country's climate change policy goals. Keeping nuclear in the country's energy mix will require gaining increased public acceptance for the technology. Recent information on public attitudes towards nuclear power shows that in Germany, as in many countries, obtaining higher levels of public acceptance hinges on the ability of the government to successfully address the radioactive waste disposal question. We therefore commend the governing coalition on its statement of intent to do this by the end of the current parliament, and we encourage the government to adhere to this deadline. Regardless of the path chosen, all citizens should be well aware of the impact of the phase-out on the country's economic, greenhouse gas and energy security goals.

ENERGY MARKET REFORM

The installation of a network regulator in 2005 signals Germany's acknowledgement that negotiated reform and internal regulation of the energy markets were unsuccessful. It also underlines the strong government commitment to genuine reform of its gas and electricity markets. In the electricity sector, real progress has been made in developing competitive energy markets and the government is working to enhance this progress by giving the competition authority more power to prevent anti-competitive behaviour. Nevertheless, the importance of establishing functional and competitive electricity and gas markets in Germany cannot be overstated, as it will lead to benefits for German customers as well as for the whole of Europe. We strongly urge the government to take further action to promote genuine competition in its energy markets.

Following the creation of a regulator, the next step in reforming the electricity and gas sectors is to institute functional access to gas pipeline and electricity transmission line networks for all market participants on an equal basis. Open, equal access to the grids provides all market participants, including incumbents as well as potential and existing new entrants, with the ability to transport their products to market. Without this access, the benefits of reform will not materialise as a competitive market is impossible. Currently, Germany's gas and electricity networks are owned and operated by large vertically integrated incumbents. This makes it difficult to guarantee that potential competitors can gain equal access to transportation, as required by the European Union because the right incentives are not in place to make the provision of fair and equal treatment in the network operators' best interests. Furthermore, by operating these networks themselves, the companies have greater access to important information, such as about network flows and schedules.

The government has tried to limit this influence through legal unbundling of network assets from the competitive parts of the business. This is the weakest means of complying with the terms of the European Union's energy directives and a model that requires close, cumbersome and imperfect oversight of market operations. Germany should learn from its experience with negotiated third-party access to networks – which failed to create sufficiently competitive markets – and now go further than the minimum requirements for legal unbundling. We encourage the government to put in place the proper incentives for non-discriminatory access to networks. The creation of independent system operators for gas and electricity networks – giving independent entities control over the operation of network assets, but not the ownership of the assets themselves – would achieve this. As the model in place in many well-functioning energy markets in Europe, the United States and Australia, it has been found to level the playing field and create the necessary foundation for competitive energy markets.

Increasing market size provides greater economies of scale, reduces transaction costs and weakens the dominance of large incumbents. Germany's four electricity zones make system operations more complex as electricity does not flow along straight lines, but through highly meshed networks. Though meshed networks are inherently more secure than radial networks (networks that rely on more direct pathways), the 4 November 2006 electricity outage in Europe highlights the complex task of managing a grid. The lack of seamless co-ordination across system areas was one factor that exacerbated the negative impacts of an event that could have been better isolated from the wider European grid. In theory, Germany's system operators could work together seamlessly as if they were one, but in practice this is more easily accomplished when all the information is managed by a single entity. We encourage Germany to consider consolidating its electricity grid management under a single independent system operator.

In the gas sector, we also recommend that a single operator be given control of the many independent grids and existing zones. This would allow more efficient, cheaper and safer operation of the existing separated pipeline networks of each company as well as enable investments in interconnections between them. A single operator would have direct access to more information about gas flows, which is essential information to guarantee security and competitiveness. Current information disclosure requirements for gas flows in Germany have resulted in little information being published. A fully independent operator would, in addition, be better able to identify bottlenecks, manage investment and administer the country's storage assets in normal or emergency conditions.

Enlarging the market area for both gas and electricity will also reduce the market concentration within Germany, a necessity given the dominance of gas and electricity incumbents in the country. Though Germany's electricity grid is well connected to its neighbours through cross-border connections, their chronic congestion signals the need for more capacity. We strongly urge the country to expand this capacity. Together, a smaller number of market zones and increased cross-border connections will not only weaken the dominance of the incumbents in Germany, but also help push the country towards an integrated European market that will enhance the stability of the region's grid and hasten the development of competition within Europe.

CLIMATE CHANGE POLICY

Germany is working to meet many targets and objectives that will lower the negative environmental impacts of energy use, especially its contribution to climate change. The country is well on its way to achieving its Kyoto Protocol target of a 21% reduction in greenhouse gas emissions in 2012 compared to 1990. In addition to this international target, the country took on the European Union target to have renewables provide 4.2% of primary energy supply by 2010, which it surpassed in 2006. The country is also on track to meet its domestic goal of producing 12.5% of electricity from renewable sources by 2010. Finally, the government has set an ambitious domestic target to double energy productivity – a measure of economic output per unit of energy – between 1990 and 2020. Taken together, these targets and the impressive progress towards adhering to them underscore the importance of environmental sustainability to Germany. However, despite this commitment, Germany lacks a co-ordinated and integrated environmental policy. While it spends a large amount of money and effort to tackle climate change with sound policies and actions, at the same time some of its other policies undermine many of its good efforts.

For example, as discussed above, the nuclear phase-out complicates the task of reducing greenhouse gas emissions, preventing the country from reaching its full potential for emissions reductions. Another measure not in line with its environmental ambitions is the country's initial proposal to the European

Commission to give relatively generous conditions for the provision of carbon allowances to new coal and lignite power plants under the European Union's trading scheme for greenhouse gas emissions. This is at cross-purposes with the target of reducing carbon dioxide emissions, as coal plants emit much more carbon than other types of power plants, most notably natural gas. The European Union's trading scheme should be used to create incentives to reduce emissions, not as a means to protect and expand coal-fired generation and enhance supply security. Efforts to promote coal-fired generation in the face of competitive and security of supply concerns should be done through means other than policies designed to provide price signals that reflect the costs of carbon dioxide emissions. A recent finding by the competition authority regarding the pass-through of emission permit costs may also have the effect of undercutting the purpose of Europe's greenhouse gas trading scheme. If companies are prevented from passing through the opportunity costs of carbon allowances, electricity prices will not reflect the cost of carbon emissions, suppressing price signals that create incentives for low- or no-carbon electricity sources. In short, it will undermine the intention of the trading scheme.

We also encourage the government to make cost-effectiveness a higher priority when selecting policies to promote renewables and between renewables policies and other policies, as this will allow it to maximise the value of its limited expenditures. The country's feed-in tariff for renewables has resulted in rapid deployment of new electricity capacity, but has done so at a high cost. Estimates show that between 2000 and 2012, the feed-in tariff will cost EUR 68 billion in total. In particular, the subsidies provided to solar photovoltaics are very high in relation to output; they will eat up 20% of the budget but contribute less than 5% of the resulting generation. In comparison, many energy efficiency measures cost multiples less in terms of their reductions in carbon dioxide emissions. The feed-in tariff has been a success at building renewable electricity capacity in the country, and we now urge the government to focus on creating sustainable market pressure to bring down the costs of operating and further developing its renewable energy resources. As renewables are well established in the market – they are set to increase to 20% of generation by 2020 – the government should consider moving towards a more flexible policy that meshes renewable resources with the full electricity market, providing additional R&D subsidies to particular technologies that require it. Not only would integrating Germany's electricity market with the internal European market be easier if its renewables promotion scheme relied more on market forces and less on government-provided guarantees, but integration would also provide renewables suppliers with incentives to build and operate the right kind of facilities in the right locations, and bring greater competitive pressure to lower costs. Turning to wind specifically, the government should continue its work to revise grid rules, regulations and operations in order to better integrate wind into the transmission system – rather than just accommodate it.

KEY RECOMMENDATIONS

The government of Germany should:

- *Reconsider the nuclear phase-out in light of the possible serious adverse consequences of its unaltered implementation for security of supply, economic efficiency and carbon dioxide emissions.*
- *Continue to reform the electricity and gas markets in order to set a level playing field for the development of genuine competition, particularly with respect to network access.*
- *Ensure consistent, co-ordinated and cost-effective climate change and renewables policy.*

Figure 1

Map of Germany

* *Länder* of the former German Democratic Republic (East Germany).

Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the IEA.

Source: *IEA.*